Sciences we have Pollination of Cucurbits, Diseases of Plants at Ames in 1894, and Distribution of Some Weeds in the United States, by Professor L. H. Pammel.—Dissemination of Plants chiefly by their Seeds, is the title of a pamphlet of fifteen pages based upon the specimens collected by the lamented young botanist Miss Mary E. Gilbreth, and after her death presented to Radcliffe College. It will prove to be very suggestive to those who wish to prepare similar collections.—" A Guide to find the names of all wild-growing Trees and Shrubs of New England by their Leaves," and " Ferns and Evergreens of New England," are two pamphlets by Edward Knobel, which deserve to be widely used in the public schools. They consist of good figures of the leaves, which should make it possible for even the non-botanical teacher to direct the attention of children to the trees and ferns. They are sold by Bradlee Whidden of Boston for fifty cents each.—We may notice here the beautiful photogravures of fungi issued by C. G. Lloyd, of Cincinnati, Ohio; the last numbers are *Coprinus comatus, Crucibulum vulgare, Lycoperdon separans* and *Urnula craterium.*—Professor T. A. Williams has published (Bulletin 43, Agricultural Experiment Station) a paper upon the Native Trees and Shrubs of South Dakota, in which he lists 37 trees and 80 shrubs. Of these, twelve trees and thirteen shrubs are found in all regions of the State. In the Black Hills, a small region including not more than one-eighth of the whole area of the State, no less than eighty-two of the one hundred and seventeen trees and shrubs are found.—Professor MacDougal writes on Botanic Gardens in the October *Minnesota Magazine.* A half tone illustration of the Botanic Institute at Leipzig, and another of the Botanic Garden at Buitenzorg, Java, accompany the paper.

VEGETABLE PHYSIOLOGY.

Changes Due to an Alpine Climate.—For ten years M. Gaston Bonnier, of Paris, has carried on experiments in various parts of France to determine just what changes occur in plants when they are transported from the lowlands to high elevations. These are described in a bulky paper in *Annales des Sciences Naturelles: Botanique,* Sé. VII, T. 20, Nos. 4, 5, 6, entitled Recherches expérimentales sur l'adaptation des plantes au climat alpin. Plants of many genera were removed from the plains, the roots or root-stocks divided into equal parts, and these parts set in similar soil and situations at various elevations, up to several thousand metres, in the Alps and the Pyrenees,

and examined from time to time for anatomical and physiological changes. These soon made their appearance and were as follows, the changes in the plants exposed to the alpine conditions being attributed principally to (1) More intense light; (2) Drier air; (3) A lower temperature. *Change of form and structure:* (1) The subterranean parts as a whole are relatively better developed than the parts above ground. (2) The rhizomes and the roots show little modification, except that the calibre of the vessels is generally smaller and the bark more precocious; (3) The ærial stems are shorter, more hairy, more spread out, closer to the soil and with shorter and less numerous internodes; (4) In general the stems have a cortical tissue that is less thick in proportion to the diameter of the central cylinder; the epidermal cells have thicker walls and the cuticle is more pronounced; often the epidermis is reinforced by a certain number of sub-epidermal layers; the different tissues of the central cylinder are ordinarily less differentiated; when bark exists, it appears earlier and is relatively thicker on branches of the same age; when there are secretory canals, they are relatively, or even absolutely, larger; finally, the stomata are more numerous; (5) Usually the leaves are smaller, except sometimes in sub-alpine regions, more hairy, thicker in proportion to their surface and often absolutely thicker, and deeper green by reflected or transmitted light; (6) The blade of the leaf acquires tissues better suited for assimilation; the palisade tissue is more strongly developed, either by a narrowing and elongation of its cells or by a considerable increase in the number of rows, the cells also contain a greater number of chlorophyll bodies and often each grain of chlorophyll has a greener tint. when there are secretory canals the diameter is relatively or absolutely greater; the epidermis of the leaf shows less differences than that of the stem, nevertheless, in general it is better developed, especially on persistent leaves, which have besides better developed protective sub-epidermal cells; the cells of the epidermis are ordinarily smaller and often the number of stomata per unit of surface is greater, especially on the upper face as M. Wagner was the first to show; (7) The petiole shows modifications generally analogous to those of the stems but much less pronounced; (8) The flowers are relatively much larger and sometimes even absolutely larger; they are more brightly colored and when the color is due to chromoleucites it is the same as in case of the chlorophyll grains, the number in a cell is greater, and often each chromoleucite is of a deeper color; the heightened color occurs also when it is due to substances dissolved in the cell sap. Experiments during eight years with *Teucrium* also show that modifications acquired

by the plant when it is taken from the plain to the mountain, or vice versa, disappear at the end of the same time when the plant is put back into its own climate. *Modification of functions*: (1) If a plant grown on the mountains is transported immediately to the level of one grown on the plains (both originally from the same root) we find for the same surface and under the same conditions, the chlorophyllian assimilation and the chlorovaporisation are more intense in the leaves brought from the alpine region; (2) If the respiration and the transpiration in the dark are compared in the same way, we find that for equal weights these functions have about the same intensity, or are less in the alpine specimens. The paper contains numerous wood cuts showing anatomical details and eleven lithographic plates comparing alpine and lowland individuals of the same species. The last is a double plate in color, illustrating the brighter hues of the mountain flowers. Foot notes refer to the principal literature.—ERWIN F. SMITH.

Spore Formation Controlled by External Conditions.— Einfluss der ausseren Bedingungen auf die Sporenbildung von Thamnidium elegans Link, by Johann Bachmann, is the title of the leading paper in *Botanische Zeitung* for July 16, 1895. *Thamnidium elegans* is a graceful little mould bearing two sorts of sporangia. The sporophore consists of a slender upright stalk, 2–4 cm. high and usually terminated by a single large sporangium, having a columella and bearing many spores. Midway down the sporophore there are usually one to ten or more whorls of branches which ramify dichotomously, often as many as ten times, the terminal divisions bearing singly on their ends small sporangia (sporangiola) generally only 6–8 μ in diameter and containing only a very few spores, usually 1–4. Sometimes only the end sporangium develops and sometimes only the dichotomous sporangioliferous branches; but the cause of this variation which is undoubtedly what led De Bary into the error of supposing Thamnidium a stage in the development of *Mucor*, has remained unknown. By varying his culture media Bachmann has discovered that he can at will produce sporophores with or without end sporangia and with or without sporongiola; in the same way he has been able to change the tiny sporangiola, which frequently bear only a single spore, into big sporangia provided with a columella and bearing many spores. As the result of his experiments he divides the fungus into six types as follows: (1) End sporangium present; sporangiola appearing very early on finely dichotomous branches which may reach the tenth subdivision, spores few. This form occured on more than a dozen differ-

ent media, the best results being obtained from the following: fresh, damp horse dung; dung decoction; agar-agar with 2½ per cent peptone; agar-agar with 4 per cent peptone and 0.5 per cent nitrate of potash. (2) End sporangia present; sporangiola 16–60 μ in diameter, with numerous spores and frequently with a columella and partial swelling up of the membrane. This type was obtained in nine different media, including the following: thoroughly cooked plums; damp bread; eggs; oranges; malt. (3) Only the end sporangium present. Obtained on slightly cooked plums and on 1 volume of malt extract in 2 vol. water. (4) Only the sporangiola present. Obtained in various culture media by raising the temperature to 27–30° C. (5) *a.* Mycelium with thick ends and gemmæ. This form was obtained in the following media: plum decoction with peptone; 1 vol. grape must in 4 vol. water with peptone; 1 vol. malt extract in ½ vol. water. *b.* Mycelium with fine ends and without gemmæ. Obtained in the following fluids: 1 per cent nitrate of potash with 1 per cent Nährlösung; almond oil with Nährlösung; oleic acid with Nährlösung; cane sugar in various percents. (6) Formation of zygospores. Not observed. According to the author, *Th. elegans* is the only fungus known which can be induced to form this or that sporangium, or none at all, by means of purely external, known conditions. He believes the production of the first type is due to substrata in which nitrogenous substances preponderate and fats and carbohydrates are present in only small qnantities, and that the second type is due to the reverse of these conditions. The paper contains 24 pages and is illustrated by a double plate.—Erwin F. Smith.

Germination of Refractory Spores.—In spite of every effort, it occasionally happens that the spores of a fungus refuse to germinate either in water or artificial media. This is true of various oospores, teleutospores and ascospores, and particularly and notably of the basidiospores of the whole group of the Gastromycetes, scarcely anything being known of the early stages of species of this group, owing to this fact. Recently, Dr. Jacob Eriksson, of Stockholm, has tried cold on a number of uredospores and æcidiospores with partial success. His method consists in placing the spores for several hours on blocks of ice or in a refrigerator at temperatures ranging down to minus 10° C. In a number of instances spores which refused to germinate in water at room temperatures, either wholly or in great part, did so freely and speedily after being on ice or in a refrigerator. In other cases the cold appeared harmful or without sensible influence, even on the same species. The opinion has been current for a long time that sudden great

changes in temperature favor the development of rust in cereals but usually this has been attributed to the indirect influence of cold in causing a deposit of dew in which the spores could germinate. In the light of these experiments this explanation can hardly be the true one. Spores which refused to germinate after lying in water several days germinated readily after exposure to cold. It would seem as if the cold were capable of stimulating the spores to germinate only when the latter have been rendered receptive by exposure to rainy weather, but further experiments and observations are necessary. It is at least certain that the spores of *Æcidium berberidis*, which germinated badly after cooling, were gathered in dry weather, while those which germinated abnndantly after cooling were gathered (on three different occasions) after several rainy days. The fungi tried by Dr. Eriksson were *Aecidium berberidis*, *Ae. rhamni*, *Ae. magelhænicum*, *Peridermium strobi*, *Uredo glumarum*, *U. alchemillæ*, *U. graminis* and *U. coronata*. The original paper, entitled Ueber die Förderung der Pilzsporenkeimung durch Kälte, may be consulted in *Centralblatt fur Bakteriologie und Parasitenkunde, Allg.*, Bd. I, p. 557.—ERWIN F. SMITH.

Botany at the British Association.—The presidential address of W. T. Thistleton Dyer before the new Section K (Botany) of the British Association at the Ipswich meeting (*Nature*, Sept. 26, 1895) is an exceedingly well written and interesting paper and one likely to obtain a wide reading. It deals with such topics as the following: Retrospect, Henslow, botanical teaching, museum arrangement, old school of natural history, modern school, nomenclature, publications, paleobotany, vegetable physiology, assimilation, and protoplasmic chemistry. The two and a half columns of sensible remarks on botanical nomenclature are specially commendable to American readers, as also what is said on teaching and in the last three topics of the address. It is certainly a surprise to learn that cramming for examinations from printed texts should be so largely taking the place of the careful study of plant phenomena in many English schools, the tendency in this country of recent years being happily in the other direction.—ERWIN F. SMITH.

Nitrifying Organisms.—Messrs. Burri and Stutzer, of the agricultural experimental station in Bonn, have discovered a bacillus (See *Centrb. f. Bak. u. Par. Allg.*, Bd. I, No. 20–21, 1895) capable of changing nitrites into nitrates and in many respects resembling Winogradsky's organism, but which *grows readily in bouillon and on gelatine.* This bacillus is much larger than the measurements given by Wino-

gradsky; like his it is incapable of converting salts of ammonia into nitrate, but unlike his is motile (when taken from colonies on gelatine or silicates), stains readily, causes slow liquefaction of gelatine, and is not yellowish but varies from colorless to bluish when grown on sillicates. The chemical activity is almost exactly the same as that of Winogradsky's bacillus and these authors, who have been studying the subject for two years, seem to think that it may after all turn out to be the same organism, the differences being less important than would seem at first sight, and resting perhaps on incomplete observations. The most important distinction appears to be the ability of this organism to grow on organic substances, but it does not appear from Winogradsky's publications whether he tried to transfer his organism from sillicate-plate cultures to bouillon, or gelatine, and failed.—Erwin F. Smith.

Relation of Sugars to the Growth of Bacteria.—Unquestionably the most discriminating and important paper that has yet appeared on this subject is a recent one, Ueber die Bedeutung des Zuckers in Kulturmedien für Bakterien (*Centrb. f. Bak. u. Par., Med.,* Bd. XVIII, No. 1), by Dr. Theobald Smith, now of Harvard. Reference is made to the literature of the subject but this is contradictory and many of Dr. Smith's interesting conclusions are largely or wholly the result of his own laborious and brilliant researches. The propositions are stated clearly and it is safe to say that hereafter no one will undertake the study of bacterial fermentation and gas production without first consulting this paper. The author's summary is as follows, but many things are not mentioned in this and the whole paper will repay the careful perusal of all who have groped about in this field of bacteriology: (1) In ordinary meat bouillon, souring and gas formation are only observed when sugar is present. Dextrose is the sugar most commonly attacked and muscle sugar is probably identical with it. (2) The formation of acid results from the breaking up of the sugar; the formation of alkali in the presence of oxygen results, on the contrary, from the multiplication of the bacteria themselves. So far as tested, the production of acid is common to all anærobic bacteria (facultative or obligate). (3) Facultative anærobiosis is made possible by the presence of sugar. (4) Rauschbrand and tetanus bacilli grew in fermentation tubes only when sugar was present. In test tubes containing the same sugar bouillon multiplication was never seen. (5) As far as tested, all gas-forming species produce along with CO_2 an explosive gas. (6) Souring as well as the production of gas are valuable diagnostic

characters, when at least three sorts of sugar are tested (with exclusion of muscle sugar). (7) Not only must the formation of gas be determined but also the progress of the same, the total quantity, and the quantity of CO_2. (8) For the differentiation of species and varieties it is of value to determine by titration the total amount of acid in 1 per cent sugar bouillon, as well as the germicidal power of such cultures on the bacteria themselves. (9) The division of bacteria into acid and alkali producers must be given up and the conditions govering the production of acid investigated more critically for each species. (10) The existence of fermentable carbohydrates in the digestive tract and in the fluids of the body is probably very favorable to the establishment and multiplication of pathogenic bacteria (both facultative anærobic and obligate, especially the latter).—ERWIN F. SMITH.

Algal Parasite on Coffee.—Under the title *Cephaleurus coffeæ,* eine neue parasitische Chroolepidee, Dr. F. A. F. C. Went describes in *Centrb. f. Bak. u. Par., Allg.,* Bd. I, No. 18–19, 1895, p. 681, an alga which he has found attacking the Liberian coffee at Kagok-Tegal in Java. This parasite appears on the leaves and berries in the form of round orange-brown spots which look bristly to the naked eye. The alga not only forms a thallus on the surface but sends its threads deep into the intercellular spaces of the host. The presence of the parasite in and on the leaf causes an interesting, protective hypertrophy of the surrounding tissue, the further progress of the alga being soon limited by a dense encircling mass of thick-walled, non-lacunose tissue, developed out of the palisade cells and spongy parenchyma of the leaf. No algal threads were found in this tissue. The berry not being able to defend itself in this way suffers most, becoming gradually brown and finally black and wrinkling and drying prematurely, so that the seed does not ripen. All parts of the alga are subject to the attacks of a fungus, which also appears to be capable of growing in the berries apart from the threads of the alga, but the relation of which to the latter and to the causation of the disease is left by the author in a rather unsatisfactory state. The paper is accompanied by a lithographic plate showing details of the alga and sections of the normal and hypertrophied tissue.—ERWIN F. SMITH.

ZOOLOGY.

On Bodo urinarius.—Although the discovery of certain peculiar infusoria in human urine dates so far back as 1859, but little is known of these animalculæ. M. Barrois has been investigating the subject